PV DESIGN WORKSHEET *WITH STANDARD INVERTER*

Based on the 2013 CEC

PROJECT ADDDRESS: _____ PLAN CHECK# _____

Breaker maximum sizes: #14 – 15A, #12 – 20A, #10 – 30A, #8 – 50A, #6 – 60A, #4 – 80A

Voc _____ Isc _____ **Table 310.15 (B) 16 (see Art. 110.14C)**

1. MAX PV VOLTAGE AND CURRENT CALCULATIONS:

a. Max PV system voltage (per NEC. 690.7):
1.12 (*1) x Voc x # of modules in series
1.12 x _____ x _____ = _____ volts
!!! Sec. 690.7C requires the Max PV voltage to be Less than 600 volts
*1 voltage correction factor section 690.7

Wire Size	Max Ampacity
14	25
12	**30**
10	**40**
8	**55**
6	**75**

b. Max PV current (NEC 690.8)

1.56 x **Isc** x # of strings in parallel. So, 1.56 x _____x _____ **=**_____ amps

(1.25 x 1.25 = 1.56. Required by section 690.8 B 1a and B2a)

2. DC CONDUCTOR AMPACITY CALCULATIONS: *(array to combiner box)* NEC310.16

a. Expected wire temp. = _____ (41 deg. C or 105 deg. F. from table 310.15 (B) (2) (a)) ***See rule K**
b. Temp. correction = .58 (refer to table 310.15 (B) (2) (a)).
c. # of current carrying conductors = _____
d. Conduit fill de-rating: .80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"
e. Circuit conductor size: _____ awg
f. Circuit conductor ampacity (310.15(B)(16)): _____amps
g. Required Circuit conductor ampacity per NEC 690.8 A info note.
1.25 x 1.25 x Isc = _____amps
1.25 x 1.25 x _____ = _____amps
h. Derated ampacity of circuit conductor per CEC 310.15 (B) (2) (a)
Temp. corr. (refer to table 310.15 (B) (2) (a)). **x** conduit fill corr. (per table 310.15(B)(3)(a)) **x** circuit conductor ampacity (CEC 310.15 (B) (16) = _____amps
.58 x .80 x _____ = _____amps

Note: H must be larger than G Yes___ No ___(check one)

3.* DC CONDUCTOR AMPACITY CALCULATIONS *(from combiner box to inverter)

a. Ambient temp. adjustment, expose conduit (CEC 310.15 (B) (C) (3) + 22 degrees ***See Rule K**
Expected wire temp. (C deg.) (CEC table 310.15 (B) (3) (c)): 41 deg. + 22 deg. = 63 deg.
Temp. correction per table 310.15 (B) (2) (A): .58
or current carrying conductors: _____

Conduit fill correction (NEC 310.15B.3.a) _____.80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"
Circuit conductor size: _____ awg
Circuit conductor ampacity: _____ amps

b. Required circuit conductor ampacity (NEC 690.8 A info note).
1.25 x 1.25 x Isc x # of strings in parallel
1.25 x 1.25 x _____ x _____ = _____amps

c. Derated ampacity of circuit conductor (NEC 310.15 b 2 (A))
Temp. correction (NEC table 310.16) x conduit fill correction (NEC 310.15B.2.a) x circuit conductor ampacity = _____amps
.87 x _____ x _____ = _____amps

Note: ***C must be larger than B Yes___ No ___(check one)***

4. AC CONDUCTOR AMPACITY CALCULATION: *(between inverter and main elect. Panel)*

A.
Expected wire temp. (deg. C) = 41 deg. ***See Rule K**
Temp. correction (NEC 310.15 B 2 (a) = .87 (no rooftop adjustment if AC conductors are not of roof)
Circuit conductor size= _____awg
# of current carrying conductors = _____
Conduit fill (NEC 310.15 B.3.a = _____.80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"
Circuit conductor ampacity = _____amps

Inverter Model # _____
Inverter maximum AC Output (for 240 V) _____A

B. (calculation B)
Required conductor ampacity (NEC 690.8 A info note):
1.25 x max. inverter output current=
1.25 x _____ amps = _____amps

C.
Derated ampacity of circuit conductors (CEC table 310.15 (B) (2) (a)):
Temp. corr. (CEC 310.15 (B) (2) (a)) x conduit fill corr. (per table 310.15(B)(3)(a) x
Circuit conductor ampacity (table 310.15 (B) (16)=
.87 x _____ x _____ = _____ amps

Note: ***C must be larger B Yes ___ No ___ (check one)***

RULES:

A. AC BREAKER: to be no more than the next standard breaker size up from (calculation 4B).

B. Bus Rating: Article 705.12D(2) states that the sum of the ampere ratings of the overcurrent devices n circuits supplying power to a busbar or conductor shall not exceed 120% of the rating of the busbar or conductor.

C. Maximum of 18 inches can cantilever beyond the standoff connection

D. AC BREAKER: to be rated to protect the conductor per table 310.16 and Art 240.4.D/240.6.A-

E. CONDUIT(S) SHALL BE PAINTED TO MATCH SURFACE AND SHALL BE INSTALLED MORE THAN ½"(INCHES) ABOVE ROOF SURFACE

F. ALL EQUIPMENT TO BE LISTED FOR THE PURPOSE.

G. Provide SOLAR PANEL COPPER LAY-IN GROUNDING LUG, TIN PLATED, 14-4, STAINLESS STEEL SCREW, SUITABLE FOR DIRECT BURIAL

H. Use #8 bond wire from Service panel to rooftop, then #6 on rooftop where exposed. (NEC 250.120).

I. Prior to the installation of the solar panels, the Contractor shall schedule an anchorage inspection for all standoffs.

J. <u>SMOKE DETECTORS SHALL BE INSTALLED:</u>

a- Centrally located in corridor (or area) leading to sleeping areas, and inside each sleeping room.

b On ceiling of upper level in close proximity to the stairway when sleeping areas are on an upper level.

c On each floor level and in basement.

d In the adjacent room (or area) where the ceiling height exceeds that of the hallway by 24" or more.

e Battery operated smoke detector permitted in existing construction.

<u>CARBON MONOXIDE SHALL BE INSTALLED:</u>

a. Outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedroom(s).

b. On every level of a dwelling unit including basements.

c. Battery operated carbon monoxide detector permitted in existing construction.

K. The ASHRAE (90.1) 2% Temperature should be used for all starting ambient temperatures. This is the temperature that is likely exceeded during 14 hours (not necessarily continuous) over a summer month (June through August). The rooftop temperatures for conduit are then adjusted for rooftop conditions. For example in Ontario the 2% temperature is 37°C or 98.6°F. NEC table 310.15(B)(3)(c) then shows us we need to add 22°C or 40°F to conduit that is placed ½" to 3-1/2" above the roof surface. The rooftop temperature measurement then becomes 59°C or 138.2°F.

<u>Definitions:</u>

<u>Combiner box:</u> used where long runs of wire occur in order to reduce cost of installing many smaller wires.

<u>Junction box:</u> used to change type of wire from "roof cable" to THWN-2